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NEBC MEETING NEWS

February 2002. Vice President Paul Somers introduced the evening's speaker, Dr. Scott Bailey, U.S.D.A. Forest Service. Bailey began his talk, "Case studies in Geobotany: Refining our understanding of the influence of substrate on plants," by mentioning that though his degree was in geology, he has always had a strong interest in botany. After winning over the crowd with this confession, he launched into a discussion of water and nutrient movement in forests. Watershed studies in the eastern U.S. examined how nutrients accumulate and predicted future changes in storage. While nitrogen had a net accumulation, mostly due to acid deposition, phosphorus and potassium storage have changed very little. Calcium (Ca) and magnesium (Mg) supplies have decreased substantially, a cause for great concern. Soil exchange sites store nutrients as cations, but there is a question as to whether mineral weathering can keep up with nutrient losses. Weathering occurs at widely varying rates (e.g., a small amount of calcite can have a much larger impact than the very common plagioclase feldspar, because calcite weathers 100,000 times faster). The potential for air pollution and land management to change the balance between mineral weathering and cation storage has renewed interest in the roles of Ca and Mg in plant distribution and health.

The first of three case studies presented was conducted on the Allegheny Plateau (NY, PA), a region that has experienced extensive mortality of sugar maple (*Acer saccharum*) since 1980. Maple death was attributed to Multiple Stress Syndrome (MSS). As its name indicates, MSS can have many causes, and in this case was due to low soil Mg levels (below 0.03 cmol+/kg) and multiple insect defoliation events during the 1970s. In the absence of defoliation, stands tolerated lower Mg levels, and with high soil Mg, stands could withstand several defoliation events. Experimental liming application in 1985 produced a positive response in sugar maple, though other species such as beech (*Fagus grandifolia*) and black cherry (*Prunus serotina*) showed no response.

The second study was an investigation of landscape patterns found in nutrient availability. Two adjacent unglaciated stands, one on a summit with low pH and Ca, the other on a mid-backslope with 100 times more Ca, illustrated the effect of physical

geography on herb diversity and MSS. Bailey and his colleagues discovered that the soil at the mid-backslope site was influenced by groundwater seepage from the underlying bedrock. Although dominated by quartz, the sandstone bedrock contained 10% calcite. Bailey suggested that acid rain played a role in MSS by increasing the portion of the landscape with nutrient levels under the threshold necessary to support healthy maple. An expansion of the study suggested that poor base cation supply is just as common in New England.

After noting the wide difference in plant diversity, Bailey and colleagues surveyed the flora with the idea of creating an indicator system for site nutrient status. Canonical correlation analysis, used to evaluate relationships between floral composition and environmental conditions, identified four species groups:

(1) Strong Indicators—confined to sites with the highest pH, Ca, and Mg;
(2) Medium Indicators—prefer higher pH and base cations but also influenced by organic matter and moisture;
(3) Weak Indicators—prefer better sites but occasionally found at nutrient-poor sites;
(4) Cosmopolitan Species—no site preference. No species reliably indicated acidic or nutrient-poor conditions.

Current efforts to explain spatial patterns in site quality involve analyzing and predicting bedrock and soil composition. While attempting to deal with these issues in northern hardwood ecosystems, Bailey simplified things by studying species that grow directly on rocks. Epipetric (rock-loving) ferns turned out to be the perfect candidates for the third case study, based on several cliffs in New Hampshire. His study showed that fern species categorized as "calcicoles" are often found on rock types considered to be Ca-poor. Three hypotheses could explain this:

(1) Plants may be rooted in Ca-rich organic matter that accumulates on rocks;
(2) The rocks have atypical mineral content, such as sandstone containing small amounts of calcite;
(3) Lengthy hydrologic flowpaths carry Ca-rich water to the ferns.

Bailey concluded his talk with suggestions for the better understanding of the influence of substrate on plants. Researchers

should focus on mineral content rather than the general lithology and should look at horizontal movement of water, rather than focusing on vertical movement. Also, GIS data should be used with discretion, because they are generally compiled on a large scale. As his research has shown, many site-specific "quirks" in soil development and hydrologic flowpaths may turn up only in a close examination.

—JENNIFER FORMAN, Recording Secretary *pro tempore*.